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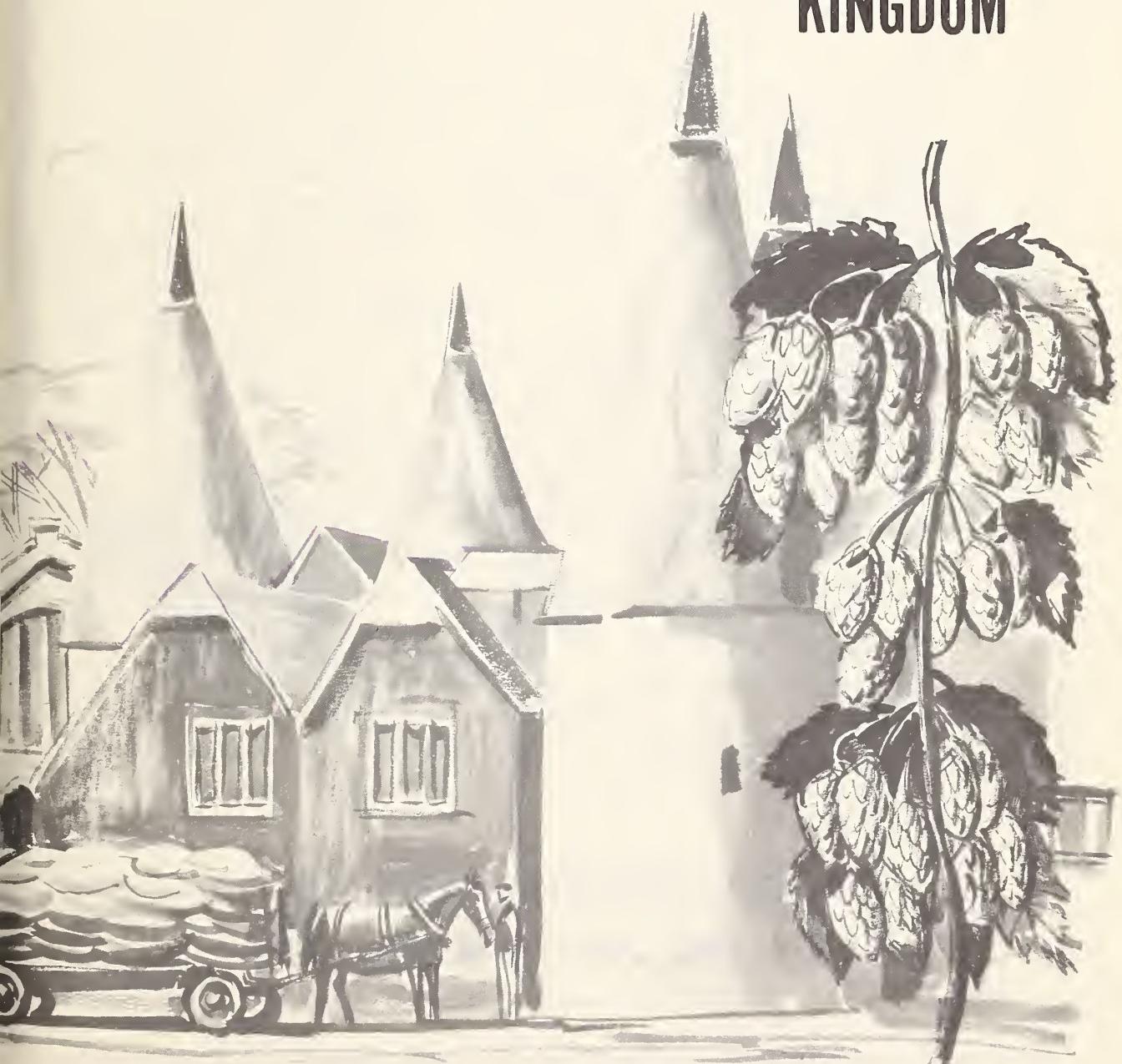
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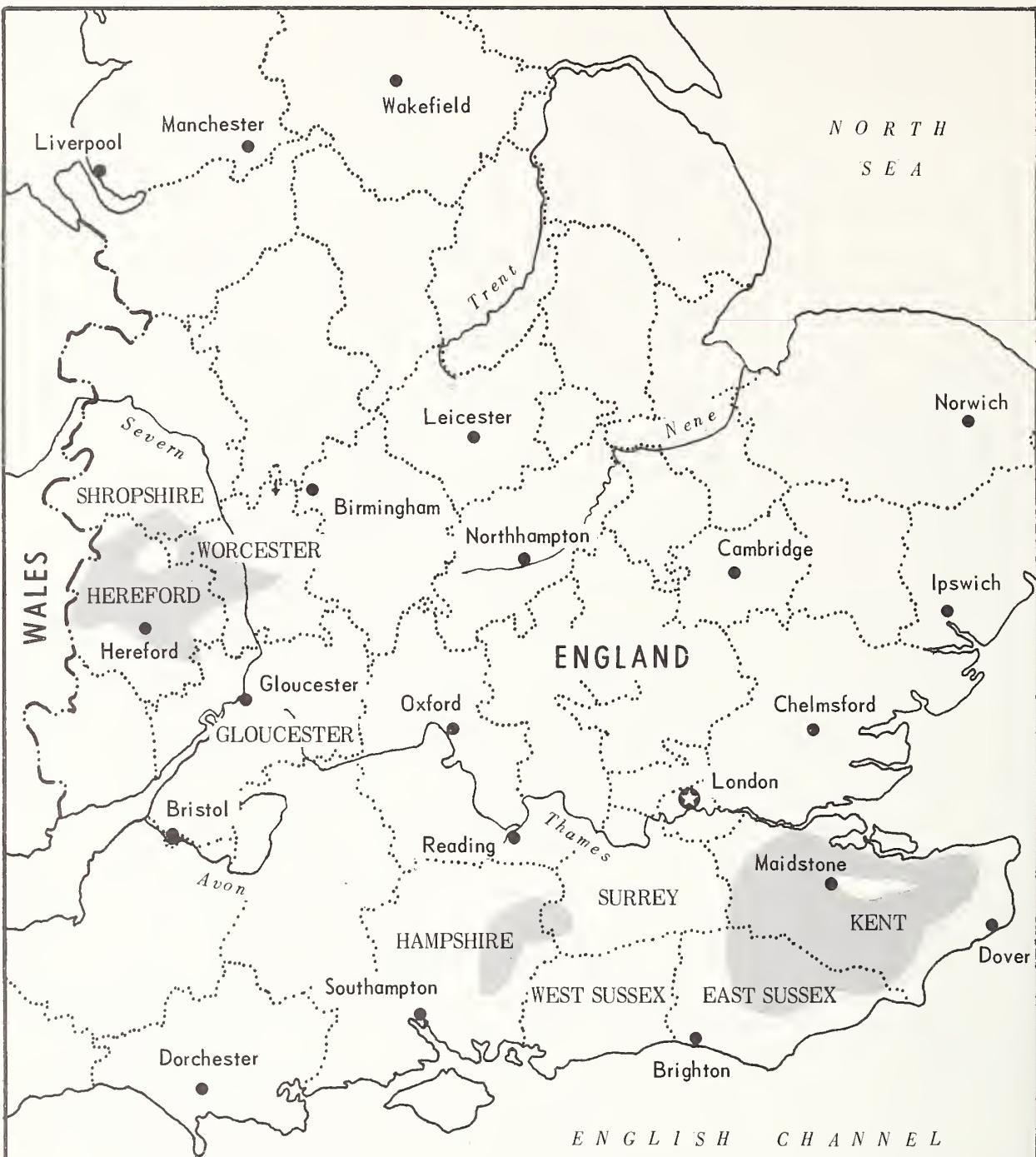
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THE HOPS INDUSTRY OF THE UNITED KINGDOM





HOP GROWING REGIONS OF THE UNITED KINGDOM

FOREWORD

Hops are used almost exclusively as an ingredient of malt beverages and there is no suitable substitute. The United Kingdom is one of the oldest hops producers in the world and is today the third largest. It also is the world's third ranking hops consumer (and beer producer).

With a largely self-contained hops economy, the United Kingdom is now neither a major market for U.S. hops nor a major competitor to the United States in world markets. It is, however, second only to the United States in production efficiency among major producers, and the relative size of both production and usage in the United Kingdom gives hops output there special potential for a world market in which demand is extremely inelastic, and supplies have fluctuated widely. These factors make information on this subject vital to the U.S. industry.

This is especially true in light of possible entry of the United Kingdom into the European Economic Community, where it could compete on favored terms with U.S. hops. Also, the recent passage of a marketing order for U.S. hops places a premium on making available information on other major markets and marketing systems.

One of the changes evident in British hops trade that is of particular interest to U.S. producers is the decline in British sales to Ireland, which is receiving increased American shipments.

This study is a result of a trip by the author to the United Kingdom in August 1965, and he wishes to take this opportunity to thank officials of the Hops Marketing Board, particularly David Fremantle and F. H. Job and David Samwells of the Wild, Neame & Gaskains firm of hop factors, who all contributed their time and knowledge. Also, to the many hop growers who gave time, hospitality, and information go special thanks.



J. W. Stewart, Director
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THE HOPS INDUSTRY OF THE UNITED KINGDOM

by ROBERT C. TORRENS, FRUIT AND VEGETABLE DIVISION

INTRODUCTION

The British hops industry, one of the oldest, entered the 20th century ranking among the world's major producers and consumers, having already made many of its production advances and achieved much of its present technical progress.

Today, the United Kingdom is the world's third largest producer of hops (fifth largest by acreage) and third largest user. Average area per grower, at 29 acres, is second only to that of the United States, among major hop growing countries; and cultural and handling methods are among the most up-to-date in the world. Growers currently control marketing and prices under the Hops Marketing Scheme of 1932 (as amended). Imports under the Scheme have dropped from an average of 5.0 million pounds in 1934-38 to 1.3 million in the 1965-66 season. Exports have, however, pretty well held their own as 2.8 million pounds were shipped in 1965-66--slightly above the 2.3-million-pound prewar average.

Hops are said to have been grown in England as early as the 16th century, although most hops used were still imported from the continent. By the early 18th century, hop growing had become widespread and a duty of 3 pence per pound was levied on imported hops. English hop growing reached its peak in the 19th century as a record 71,789 acres were grown in 1878 and a record crop of 86,928,000 pounds harvested in 1886.

Evidence of the high interest in hop growing at this time is seen in the new scientific and cultural developments. During the 19th century growers paid increased attention to improving varieties, cultural methods, and processing. Such important varieties as Goldings, Fuggles, and Bramlings were introduced and displaced many older varieties. Cultural practices included dusting and spraying as methods of insect control, the use of overhead wirework including training by the Butcher system (still used in Kent), heavy use of barnyard manure and the introduction of chemical fertilizers. Formal research in hop culture also started in the 19th century with the establishment of Wye College as an agricultural school in 1894. Work there included disease identification and control, development and testing of new varieties, and fertilizer application trials.

Early in the 20th century some major new trends had manifested themselves: a rapid decline in acreage, the concentration of hop growing into approximately the same general area that it occupies today, forced air drying of hops, and increased mechanization in production and processing. Like growers at an earlier period, brewers started showing increased interest in advanced technology, particularly in chemical analysis of hops, and in improved efficiency in their use. At this time, growers began to be conscious of the possibility of controlling the hops market to avoid characteristically drastic price fluctuations resulting from variations in production.

With a fairly high degree of mechanization and relatively large acreage per grower, the cost of production of hops is lower in England than on the continent but not as low as in America. This indicates a competitive advantage in favor of English over other European growers but in favor of American growers over English. Actually, because of the wide differences in types of hops produced and because of the controlled market, this is largely academic in terms of actual competition.

PRODUCTION

The United Kingdom produced 25,639,000 pounds of hops on 20,304 acres in 1966 and was the world's third largest hops producing nation. This level represented a downward drift during the century, as it was 14 percent below the 29.7 million-pound English average for 1950-64 and less than two-thirds of the 1900-14 average of 43 million pounds. The latter production level had ranked second highest in the world.

Part of the drop may be explained by a shift to more food crops during World War I, but in addition a major reduction in acreage was made (temporarily) under Hop Control (a government regulatory program) from 1917 to 1924. A later more permanent reduction was planned and achieved under the Hops Marketing Scheme (1932 to the present) as a means of raising prices.

Under the Scheme, hops production has averaged 29 million pounds for the past 35 years. Production over the long term seems to have stabilized and in addition, year-to-year production variations have been kept amazingly low under the Scheme. The greatest yearly change was from 28 million pounds in 1949 to 41 million in 1950 and this was all caused by a change in yield, as the acreage showed virtually no change that year.

During the 1950-64 period, the area under hops averaged 21,000 acres as compared with 42,000 acres during 1900-14. A substantial increase in yields has partly offset this 50-percent reduction in acreage, but as noted above there was still a considerable reduction in the crop. During the past 20 years, acreages and yields have shown no appreciable trend. However, the number of growers has declined from 951 in 1950 to an estimated 700 in 1966, or 26 percent, and as a consequence the average area per grower has risen from 23 to 29 acres.

Before the Scheme came into operation, England had usually ranked as the world's largest or second largest hops grower. During the early years of the Scheme this changed to a steady second place, which in turn has dropped to a constant third during the past 10 years. As time passes, the portion of the world crop produced in the United Kingdom is expected to decline still further, as other areas increase production while that in the United Kingdom remains stable.

Costs and Prices

A major feature of the Scheme is the effort each year to determine an "average" cost of production--including "profit"--and to try to cover this cost fully to the grower through the pricing mechanism.

Every year the Permanent Joint Costing Committee of the Hops Marketing Board estimates the cost of producing English hops by surveying selected hop growers' costs to establish the basis for the price of hops. This official survey takes into account such direct out-of-pocket costs as the machinery, material, and labor used in growing and harvesting the crop. It also includes a proportion of the farm overhead expenses to be charged to the hops crop. An allowance is included for land rent (about \$14.00 per acre), interest on investment (5 percent), and a return to management. In addition, an amount equal to 7.5 percent of investment is charged off as "profit." The total of these items is called the "farmgate cost."

Table 1.--British hop producers and production, selected data,
average 1945-59, annual 1950-66

Year of harvest	Registered producers	Total hops acreage, June 4	Total production	Average area per producer ¹	Average yield	Average grower price ²
	Number	Acres	1,000 lb.	Acres	Pounds/acre	U.S. cents/lb.
Average: 1945-49.....	(³)	21,807	30,335	(³)	1,391	(³)
Annual:						
1950.....	951	22,198	41,251	23	1,858	52.5
1951.....	945	22,460	36,004	24	1,603	65.3
1952.....	933	22,279	31,623	24	1,419	70.4
1953.....	924	21,932	30,530	24	1,392	68.8
1954.....	913	20,760	27,552	23	1,327	72.5
1955.....	868	20,458	28,764	24	1,406	68.5
1956.....	848	19,992	20,627	24	1,032	87.8
1957.....	836	20,415	29,979	24	1,468	69.4
1958.....	833	21,130	33,896	25	1,604	68.2
1959.....	800	20,350	25,051	25	1,231	81.4
1960.....	769	20,098	27,915	26	1,389	77.3
1961.....	748	19,681	22,818	26	1,159	88.9
1962.....	744	20,319	29,883	27	1,471	74.2
1963.....	735	20,957	30,955	29	1,477	78.2
1964.....	⁴ 720	20,880	28,269	29	1,354	86.8
1965.....	⁴ 710	20,687	28,977	29	1,401	89.1
1966 ⁵	⁴ 700	20,304	25,639	29	1,263	96.2

¹ Column 2 ÷ column 1 (small number of unregistered producers not included). ² Before deduction of Board Expenses and Factors' commissions. ³ Not available. ⁴ Estimated.

⁵ Preliminary.

Source: U.K. Hops Marketing Board.

Finally, the automatic checkoffs that the Board makes from each grower's account to cover its own expenses and factors' commissions are included. These are called "marketing costs." The sum of these marketing costs and the above-mentioned farmgate cost, when divided by the estimated yield of producing acreage, represents the "average producer price" which the Board tries to secure for growers, as determined on a year-to-year basis.

An analysis of cost-of-production figures shows that production costs have risen somewhat in recent years. They increased from \$1,033.21 per acre in 1952 to \$1,251.36 per acre in 1964, despite lower harvesting costs resulting from increased mechanization. Reasons for the increase in costs include the rising cost of labor and the increased production expenses resulting from use of more (and more expensive) pesticides, machinery, and other materials.

Marketing costs are also going up, partly as the result of the increase in services and facilities provided by the Hops Marketing Board. But a major factor in the increasing cost of production is the 35 percent increase in the allowance for land rent, interest, management salary, and profit. For the grower who owns and manages his own hops farm and has little out-of-pocket cost for these items, this represents an increase in net income.

The inclusion of an allowance for profit in the "cost of production" estimate is (according to U.S. standards) unusual. At first this was calculated as equal to 20 percent of other costs. Starting in 1963, however, "profit" was calculated as a percentage of capital investment to compensate growers for keeping down the increase in costs (being "efficient") in relation to other industries. This "increase in efficiency" then is partly unreal in the sense that it doesn't make English hops that much less expensive. In spite of this, however, English hops are still less expensive than those of all major hops producing countries except the United States, mostly because of the relatively large acreage per grower.

Table 2.--U.K. HOPS: Cost of production per acre, selected crop years

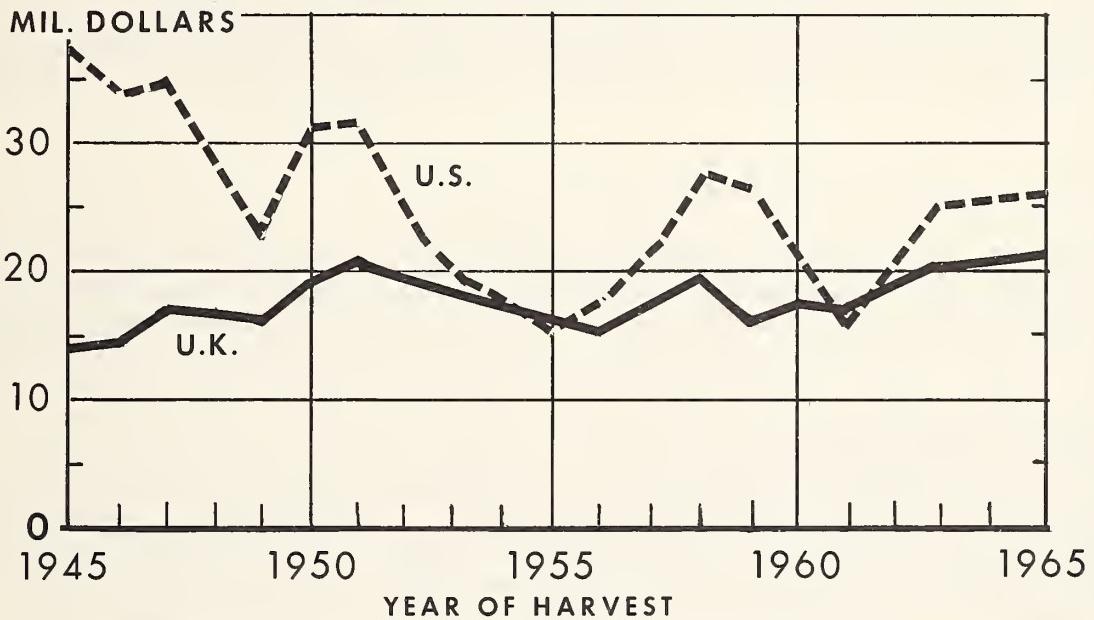
Item	1952	1960	1964
	US\$ per acre	US\$ per acre	US\$ per acre
Growing costs:			
Labor.....	107.43	108.36	132.66
Fertilizer.....	100.94	88.40	92.64
Pesticides.....	31.37	33.37	48.34
String.....	44.01	33.57	45.97
Total growing costs.....	283.75	263.70	319.61
Harvesting costs:			
Picking expenses.....	206.50	138.17	113.42
Drying labor.....	20.93	25.97	26.44
Fuel.....	28.04	25.88	20.71
Packing material.....	28.02	20.20	22.97
Total harvesting costs.....	283.49	210.22	183.54
Farm overhead expenses.....	62.73	64.13	71.61
Equipment maintenance.....	100.29	207.71	238.16
Allowance for land, rent, interest on investment, management and profit.....	263.98	275.05	357.56
Total "farmgate cost".....	994.24	1,020.81	1,170.48
Marketing costs:			
Board expenses.....	¹ 16.63	40.68	44.79
Factor's commission.....	22.34	28.68	36.09
Total production and marketing cost.....	1,033.21	1,090.17	1,251.36
Yield calculated (pounds per acre).....	1,478	1,411	1,445
Cost in cents per pound ²	70	77	87

¹ Does not include certain transportation, sampling, and handling costs which are included in Board expenses from 1955 forward. ² Total production and marketing costs ÷ calculated yield.

Source: Derived from U.K. Hops Marketing Board data used to compute "cost of production" and "average price".

English hops prices have been rising more or less steadily almost from the beginning of the Hops Marketing Board's creation, but without the extreme fluctuations that marked the pre-Board period. Also, English prices have been more uniform than world prices which rose during the same period. A further benefit of the Board's pricing actions was that while production rose and fell with changes in yields and acreage, the total value of hops production (and thus farm income from this crop) was surprisingly stable particularly when compared with grower returns in the United States.

COMPARISON OF TOTAL GROWER RETURNS FROM HOPS, U.S. AND U.K.



SOURCES: AGRICULTURAL STATISTICS USDA; REPORT ON AGRICULTURAL MARKETING SCHEMES,
U. K. MINISTRY OF AGRICULTURE; U.K. HOPS MARKETING BOARD.

Areas of Production

Hops production in the United Kingdom is concentrated in the stream valleys and on hillsides bordering them in two areas of England.

The larger of these is the South East region--located between London and the southeast coast, and spread throughout most of the county of Kent and into Sussex. The Eden, Medway, Stour, and Rother rivers flow through the area, and Maidstone is its largest town. There is a small growing district in England's mid-south, which lies in eastern Hampshire county and western Surrey, and which is usually considered a part of the South East region. The Wey river flows through this area. The Hops Marketing Board has a large warehouse (5 floors with about 150,000 square feet of floor space) at Paddock Wood to serve the entire area. It handles up to 40,000 "pockets" (actually cylindrical bales) of about 170 pounds each or somewhat less than half the crop in the region.

The smaller growing region called the West Midlands--not far from Birmingham--lies mostly in Hereford county but it also extends well into Worcester and slightly into both Gloucester and Shropshire. The Wye, Lugg, Teme, and Severn Rivers flow through the area.

SOIL REQUIREMENTS.--Because of the heavy investment in semi-permanent improvements such as wirework and lewing (man-made windbreaks) required for a hop yard, a grower must select the site and the system of training with care. Most hops are very sensitive in their soil requirements. A fertile well-drained deep porous soil is essential. In the South East region, hops are grown on light, medium, and heavy loams, mostly deep alluvial soils of river and stream valleys, and in the West Midlands, on similar soils of the Teme and Severn River valleys and on heavy red marls.

All hop-growing areas in England usually receive 25-35 inches of rainfall a year, with precipitation spread pretty evenly throughout the year. Because of this, irrigation is rarely used.

Winds are a serious problem in all areas, and both natural windbreak hedges and a windbreak called lewing (made of a fiber mesh hung on poles) are used on the windward side of the fields. Also because of the wind, wirework in England is somewhat lower than in the United States or on the Continent.

Varieties

English growers probably raise more name varieties than do growers in any other country, partly because of the long history of the industry, which afforded time to develop varieties to meet different needs. These varying needs are partly those of the brewer (such as high resin and alpha-acid content) and partly those of the grower (such as high yield, wilt resistance, vigorous growth). Nearly all grown are seeded hops which are required for English-type "top fermented" beers, as contrasted with the seedless hops used to make lager beers on the Continent and in the United States.

Among the varieties or types grown are (in the order of their 1964 popularity): Fuggles, Goldings, Whitbread's Golding Variety (W.G.V.), Bullion (Q 43) and Northern Brewer (WFB 135). Of these, only W.G.V. is classed as verticillium wilt tolerant. There are, however, several other wilt-tolerant varieties which are not yet widely grown. These will be covered under the "other" category below.

FUGGLES.--The Fuggle is a seedling variety introduced in 1875, which has been extremely popular with both growers and brewers for years, still providing well over half the crop each year.

One of its major attractions to growers is its resistance to downy mildew. It also tolerates thinner soil than most other varieties. However, because of excessive verticillium wilt damage, growers are beginning to switch to wilt resistant types. In 1964, for the first time in over 3 decades, Fuggles made up less than 60 percent of the English crop.

GOLDINGS.--Goldings is actually a category of clonal selections of common ancestry. It has gained substantially in importance in recent years. In 1964, it made up 23 percent of the crop. Some early-maturing Goldings are Bramling and Amos's Early Bird, which are moderate yielders. Cobbs, Eastwell Golding, and Petham Golding are mid-season vigorous growing types capable of high yields. Cobbs has only a moderate alpha-acid content while the others are regarded as high in alpha-acids. Rodmersham Golding is another mid-season hop in this group. It has a high alpha-acid content but is susceptible to canker (*Fusarium*). Mathon and Canterbury Golding are

late-maturing vigorous growing types capable of good yields. Both produce high-quality hops of high resin content but are seriously affected by downy mildew, by which Canterbury Golding is often completely destroyed.

W.G.V.--One of the newer and more rapidly expanding varieties is Whitbread's Golding Variety (W.G.V.), of which over 10,000 pockets (7 percent of the total hops crop) were delivered to the Hops Marketing Board in 1964, contrasted with only 9 pockets in 1954. Believed to have been a seedling, it was discovered in 1911. W.G.V. is wilt-tolerant but is considered somewhat lacking in vigor; it is late-maturing and the cones do not "hang well" for machine-picking.

BULLION.--Bullion (Q 43), a seedling cross between a Canadian wild hop and an English commercial variety, is very rich in resins and strong in aroma. Because of the latter there is little demand for Bullion, at present priced below most other varieties. This variety is grown in all districts and thrives on a wide range of soils. It is a very vigorous grower and needs higher wirework than most other English varieties to avoid bunchy heads or tops (which would cause problems in use of picking machines).

NORTHERN BREWER.--Of all varieties grown in England the Northern Brewer (WFB 135) has the highest total resin content and highest "bitter value", as well as a Golding-type aroma which is readily accepted by most English brewers. It is a seedling cross of the Canterbury Golding and Brewers Gold. It does best on a heavy soil, and shows only moderate vigor, but under proper conditions it has a good yield. Northern Brewer's popularity is growing; acreage has increased from a negligible level before 1950 to 3 percent at present.

OTHERS.--There are numerous other varieties grown to a lesser degree. One, Bramling Cross (OT 48), is a wilt-tolerant seedling of a British commercial variety crossed with a wild Canadian hop. It makes up about 2 percent of the English crop. Tutsham is a mid-season hop which makes up another 2 percent of the crop. Keyworth's Midseason (OR 55) is a high-yielding second-generation seedling of a wild hop from New Mexico crossed by open pollination. It is wilt-tolerant, adaptable to many soils, and easy to pick. However, it makes up only 1 percent of the crop--mostly because of brewers' dislike of its aroma. Many other varieties have been developed which are still of only limited commercial importance.

Research workers are currently trying to develop triploid varieties, containing a double set of chromosomes from the female parent and thus strongly resembling that parent in growth habits and cone characteristics. A young bud is chemically treated to produce a shoot with a double compliment (4 sets) of chromosomes; this is propagated and bred to a normal male, which furnishes a third set of chromosomes by pollination. The male then is used to introduce one or two specific desirable factors such as disease resistance without serious alteration of other basic characteristics supplied by the female parent. Open-pollinated triploids resulting from the trials have been more vigorous than their female parents and nearly seedless, a characteristic which is a disadvantage because English brewers want seeded hops for brewing English-type beers. However, this work is only in its early stages and will require the test of time.

Table 3.--Classification of English hops crops by variety, averages 1935-39, 1940-44, 1950-54, 1955-59, annual 1960-65

Year of harvest	Fuggles	Goldings	WGV	Bullion	Northern Brewer	Bramling Cross	Tutshams	Keyworths Midseason	Other
	Percent of total	Percent of total							
Average:									
1935-39.....	76	13	(¹)	(¹)					
1940-44.....	78	13	(¹)	(¹)					
1950-54.....	75	13	(¹)	(¹)					
1955-59.....	67	17	(¹)	(¹)					
Annual:									
1960.....	62	18	4	2	4	1	(²)	1	8
1961.....	60	18	4	3	3	1	(²)	2	9
1962.....	62	³ 19	5	4	3	1	2	2	2
1963.....	60	³ 21	6	3	3	2	2	1	2
1964.....	57	³ 23	7	² 3	3	2	2	1	2
1965.....	58	³ 21	(¹)	(¹)					

¹ Not available. ² Included in others category. ³ Includes Cobbs for the years 1962 to date; earlier, Cobbs is included in others category.

Source: Calculated from data of the Hops Marketing Board and Wigan Richardson & Co.

Cultural Methods

The English hop grower uses advanced techniques more fully than any other except perhaps his American counterpart. This probably includes use of more soil additives; than other European growers as well as the tendency to employ such practices as chemical defoliation instead of hand-stripping. He is also probably second only to the U.S. hop grower in using and adapting machinery to hops production and harvesting. In short, in terms of efficiency and of productivity, his operation ranks high.

PROPAGATION.--Hop growers propagate most of their own plants, needed in large numbers to replace dead or diseased plants, to replace old varieties with new, and to plant new yards. English growers normally propagate by means of "strap cuttings," taken from the mature underground portions of the stem during the dormant period, in contrast to the "root" or rhizome cuttings used in the United States.

To get a sufficient length for cuttings, the grower mounds earth around the base of the bine in the summer before the cuttings are to be made. Cuttings are usually rooted in a nursery bed the first summer and transplanted to their permanent locations that fall or the following spring. This method produces only 4-8 cuttings per healthy hill and does not multiply a scarce stock fast enough for all purposes.

A more rapid method in general use is called layering, consisting of covering a growing bine in a shallow trench up to within 6-12 inches of the tip. As the plant continues to grow, it is progressively covered. As the stem matures underground, it thickens and develops potential root tissue at the nodes. Cuttings are made about 5 inches long with one node to each cutting. These are planted in nursery beds and treated like the cuttings described above. Up to 50 or more cuttings per healthy plant may be obtained by this method.

In recent years, the development of mist propagation has made it possible to take softwood cuttings from laterals and root them. This system utilizes a greenhouse and a mist spraying system which automatically maintains a high humidity. Cuttings may be mist-propagated at any time during the growing season, and it takes only about 2 weeks to root them sufficiently for setting

into nursery beds. The fact that many cuttings may be made from a single plant coupled with an extremely high survival rate makes mist propagation the most rapid method of increasing a scarce stock such as disease-free plants or a new variety. However, the equipment is more elaborate and more expensive than that used for other methods.

PLANTING.--Rooted hop sets are planted any time from November to March, preferably in the fall so that the plants have plenty of time to settle in and begin new root growth before spring. Sets are trimmed of dead material and coarse or damaged roots. Spacing depends on the variety grown, methods of stringing, and cultivation to be used. Plant spacing of 6.5 X 6.5 ft. (1,032 plants per acre) has been found to produce the highest yields for most varieties in the South East. A common spacing in the West Midlands is 3.5 X 7 ft. giving 1,778 plants per acre.

WIREWORK AND TRAINING SYSTEMS.--The type of wirework used depends on the training system to be employed. However, most growers use chestnut poles to support heavy gage "bearing" wires as shown in the training diagrams. These bearing wires, in turn, support "parallel" wires (so-called because they run parallel to the hop row). These, in turn, support the coir yarn strings up which the hops are trained. The wirework is an integral system and a failure in one part of it can cause a collapse of the entire field.

The height of English wirework varies from under 13 feet for some Butcher systems to 18 feet or more for some Umbrella-trained hops of more vigorous varieties. Field trials by Wye College in Kent showed that 16 feet was the optimum height for Fuggles and 18 feet was best for Bullion and Northern Brewer. Many of the trellis systems under 16 feet high are carried over from the time before machine picking was used. Also, the wirework tends to be higher in the West Midlands than in Kent. Since the trellis or wirework is a semi-permanent structure and very expensive to build, the system of training must be selected with care.

DRESSING.--Dressing is the process by which the crown, which remains in the earth throughout the year, is prepared for the coming season. In the late fall or early spring after spreading manure, compost or other organic material, the English hop grower plows it under using a mold-board plow with opposing bottoms. These turn about 6 inches of soil away from the row on each side and into the center of the "alley." This leaves a ridge-like hop row 12-16 inches wide and ready for dressing. A hand-guided disc blade is sometimes attached to the rear of the plow and used to cut away most of the ridge between plants. This reduces the amount of hand-hoeing needed.

After the ridge is exposed, the remaining earth is hoed away to bare the crown, which is then dressed or pruned by removing runners, remaining bine stubs from last year's growth, and dead or diseased material. At this time, strap cuttings are taken from the bine stubs to be used for propagation, and missing hills are replanted.

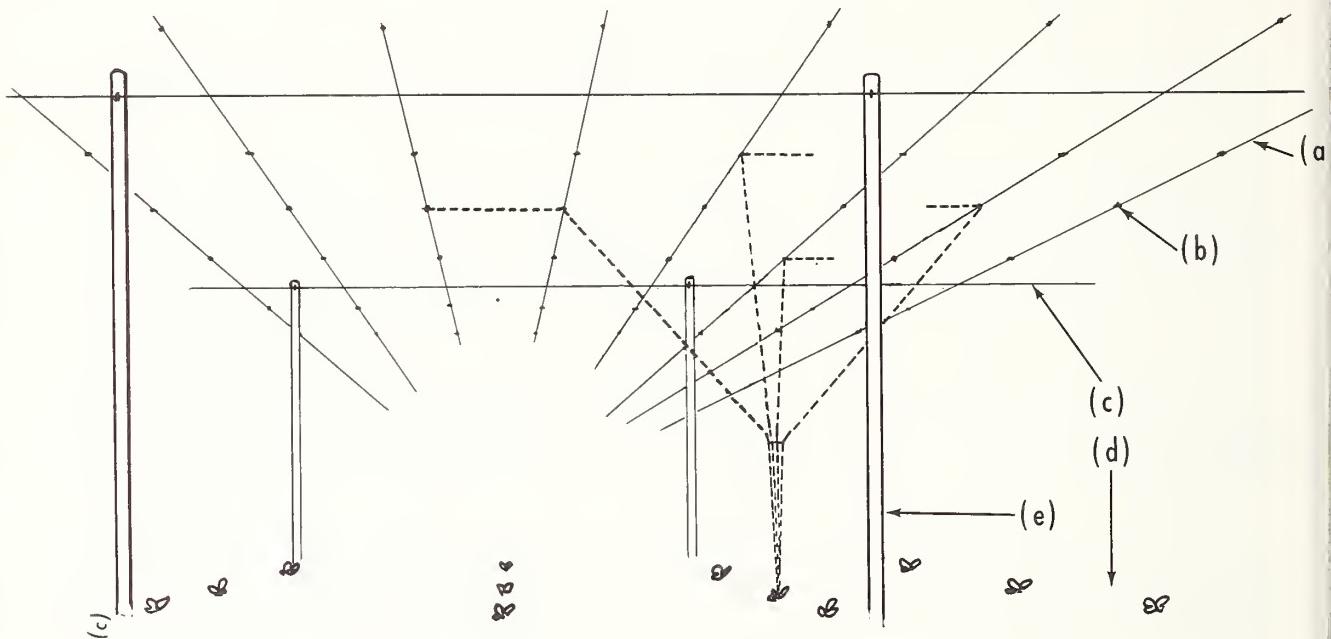
A dressing machine, consisting of a power-driven rotary cutter, which is carefully lowered over the center of the crown cutting a neat circle around it, is used by some growers. Field trials at the Rosemaund Experimental Husbandry Farm in the West Midlands have shown that November-dressed hops fruit earlier but that a late March dressing produces the highest yield, possibly as a result of the hops coming into burr at a better time.

TRAINING.--Each spring, as soon as there are numerous new shoots 1-2 feet long, the British grower selects the ones which will grow the year's crop and removes the remaining ones. Usually, with a vigorous variety (like Bullion), the strongest shoots are discarded and only moderately strong shoots are trained. However, it has been found at Wye College that for a less vigorous variety (like Fuggle), the highest yields are obtained by training the stronger shoots. From 1 to 3 shoots are wrapped gently in a clockwise direction around the string, with the number of shoots depending on vigor of the variety, number of strings per hill, spacing of hills, and fertility of the soil. As soon as all needed bines are trained, excess shoots, as well as the bottom

THE UMBRELLA SYSTEM.--The Umbrella system of training is most popular. Used almost exclusively in south Kent and in Sussex, quite often in north Kent, but only occasionally in the West Midlands and rarely in east Kent, this is the best way to train a large number of bines per hill, and makes cross-cultivation possible.

For the Umbrella system, plants are set in a 6.5 X 6.5 ft. (or wider) square spacing, with poles placed at every third hill in every other row. There are 2 "parallel" wires per row of hops. The hops may be trained either diagonally, using the two nearer parallel wires and the next wire on either side as shown above, or else "upright," with two strings to each of the two nearer wires, for better light penetration. A continuous coir-yarn string is usually employed (rather than single lengths as used in the United States) and is strung from a corkscrew wire peg by the hop hill (d) up over a hook (b) attached to the parallel wire (a), over to a second hook, back down to another peg and so on until there are 4 strings per hill. These 4 strings are gathered and tied together at a point about 5 ft. above ground to allow machinery to move closer for cultivation. Stringing is done from the ground with a long pole, because the string is looped over hooks rather than tied to the wire as in the United States. A half-hitch at every second hook keeps broken strings from loosening neighboring strings.

UMBRELLA SYSTEM



(a) Parallel wire

(b) Hooks attached to parallel wire

(c) Bearing wire

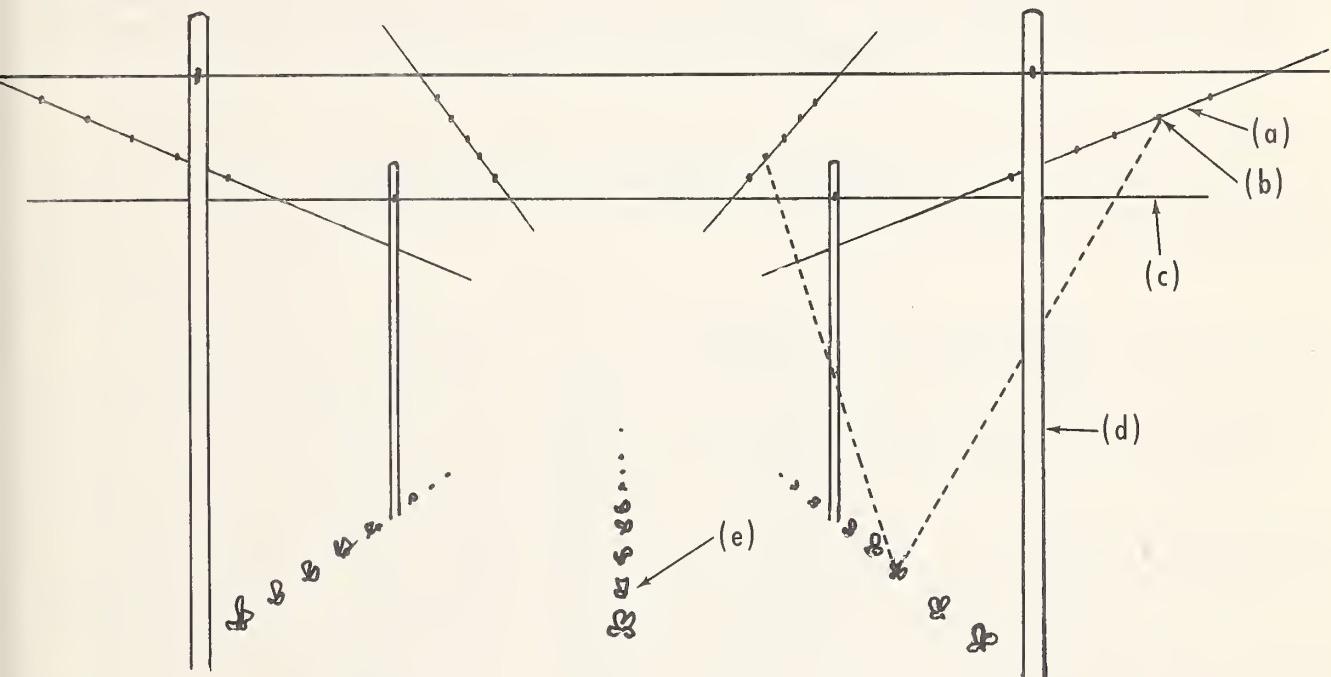
(d) Hill

(e) Pole

THE WORCHESTER SYSTEM.--The Worcester system of training is best suited for less vigorous varieties or thinner soils where a hill will support only a small number of bines. It is popular in the West Midlands where only 2 strings are usually trained per hill and where the hops are not cross-cultivated.

The Worcester system uses the same basic wirework as the Umbrella system but with only one parallel wire per row. Hops are plated 3-4 feet apart in rows 7 or 8 feet wide, with poles at every fifth or sixth hill in every other row. This gives almost twice as many hills per acre as for the Umbrella system, but with only 2 strings per hill the number of bines per acre remains about the same. Since cross-cultivation is impossible, the row is gradually ridged up during the season, covering weed growth before it becomes a problem. Stringing is done as for the Umbrella system except that each hill has two strings fastened diagonally to each of the two nearer parallel wires.

WORCHESTER SYSTEM



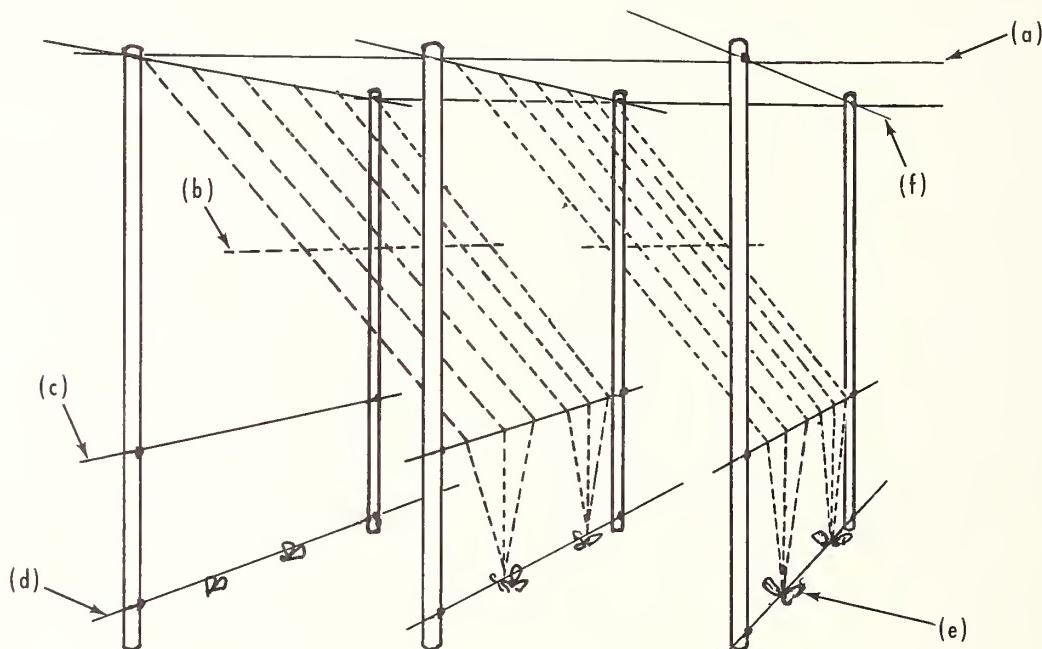
(a) Parallel wire
(b) Hooks on Parallel wire
(c) Bearing wire

(d) Pole
(e) Hop hill

THE BUTCHER SYSTEM.--The Butcher system of training is less popular than in past, during the days of hand picking. Because of the close spacing of the bines, laterals tend to become too tangled and cause problems for machine picking. The close poles and low "breast wires" generally hamper machine operations. This system derives special stability from the extra poles, from a directional pull of the plants which helps anchor it from the windward side, and from the anchor wire (a) (which also serves as a bearing wire) running crosswise along the top of each pole to which it is securely clamped. This anchor wire is attached to a "dead man" on two sides of the field and the parallel wires (f) are secured in the same fashion on the other two sides. This system is best for keeping wind damage at a minimum as most laterals hang under the sloping strings away from the prevailing wind.

Hops are spaced 5.5-7 ft. in rows 6.5-8 ft. apart, with poles set between every second or third plant in every row--about twice as many poles per acre as with the Umbrella and Worcester systems. Three or four strings per hill (e) are stretched out in fanlike fashion from a bottom wire (d) (or corkscrew peg) about 6 inches above the hops row, to a breast wire (c) running directly above the row about 4-5 ft. high. From the breast wire, the strings run parallel with each other on a slope, away from the prevailing wind, up to the parallel wire above the next hop row. The string (usually coir yarn) is cut into lengths which will reach up from the hop hill to the parallel wire above the next row and is usually tied by a highly skilled worker on stilts. Sometimes a bracing string (b) is laced through the hill strings to add stability.

BUTCHER SYSTEM



(a) Anchor wire
(b) Bracing string

(c) Breast-wire
(d) Bottom wire

(e) Hill
(f) Parallel wire

pair of leaves of each trained shoot, are removed. If calm weather should prevail, the hops would continue to train themselves from this point on. However, occasional winds are common in all English hop-growing areas, and a second training is usually needed.

Recent trials have shown that hops will train themselves under English conditions but yields are lowered somewhat, disease problems are intensified, and machine picking is made somewhat more difficult. With hops prices and wages at present levels, the saving in labor does not compensate for the reduced crop and for other expenses incurred under self-training.

STRIPPING.--As an effort to help control disease, stripping removes all leaves and laterals from the lower section of the hop bine (which does not normally fruit anyway). Stripping is performed in several stages. The bottom 8 inches is stripped when the bine is about 6 feet high; afterwards, an additional 1-2 feet is cleared every few weeks until the bine is stripped to about 6 feet high. This should be timed to just about coincide with the growth reaching the top wire (usually in July).

To try to reduce costs, some growers have switched from hand stripping to chemical stripping (after the first 8 inches are cleaned by hand). This involves waiting until the lower 6 feet of the bine has hardened; such delay heightens the risk of a downy mildew outbreak. Chemical stripping is done with a solution of tar oil and a defoliant specially prepared, with coarse spray mist directed downward, and spraying done on a windless day if possible.

SUMMER CULTIVATION.--After the hops have been trained up out of the way of machinery, they are cultivated several times to keep down weeds, reduce evaporation, and mix additives into the soil. Some experimental work has been done at Rosemaund Experimental Husbandry farm using a pre-emergence herbicide in lieu of cultivation. Results so far have been satisfactory but long-term testing is still being done to learn the carry-over effects of the treatment and to see how long hops can go without dressing the crown in the spring.

SOIL ADDITIVES.--While soil texture or particle size is important for root penetration and subsoil drainage, most English hop growers rely on good soil structure or tilth to keep the topsoil porous. They plow in very heavy doses of barnyard manure (up to 15 tons per acre), straw (4 tons or more per acre), textile mill waste (called shoddy) or any other organic material available. Of course, heavy nitrogen applications are needed to offset the nitrogen used up by the micro-organisms which break down this organic matter.

As an alternative method, sod cover with no cultivation is being tried to keep the topsoil open (and to help check the spread of wilt). However, the grass competes for water and nutrients during the growing season and the soil tends to warm more slowly in the spring. Also, more hand work is required in exposing the hop crown for the usual pruning or dressing in the spring.

The total nutrient content per acre of a good crop of English hops has been found by Wye College to be: 90 pounds of N, 34 pounds of P_2O_5 , 84 pounds of K_2O , 16 pounds of MgO and 112 pounds of CaO. These quantities of course vary considerably with the crop weight, soil fertility, variety of hop, and the like. At any rate, these estimates show the heavy demands made on the soil by this crop.

English farmers are renowned for their heavy use of fertilizers and the hop grower is no exception. If anything, experts at Wye say that many English hop growers apply too much fertilizer. In addition to the excessive cost of over-fertilization, too heavy an application of nitrogen will cause hops to produce excessive foliage growth at the expense of cone production. In addition, the succulent growth invites fungus disease problems.

To establish economic rates of use, fertilizer application trials have been conducted over a wide range of soils and under a wide range of conditions. The application currently recommended at Wye under general conditions is: 13 short tons of barnyard manure plowed down in the winter, 47 pounds of N, 20 pounds of P_2O_5 and 67 pounds of K_2O applied at the beginning of the growing

season, and a top dressing of up to 450 pounds of a nitrogen fertilizer such as sodium nitrate applied well before the first of July. This is substantially less than the "normal" applications by many English growers. Although the hop is a heavy feeder on calcium, plenty of this element is furnished by the phosphate fertilizers. Wye experts recommend that the soil acidity level be maintained at a pH of 5.5-6.0 for optimum economy because certain elements such as potassium become more available in that range.

PEST AND DISEASE CONTROL.--English hops are ravaged by a number of diseases. Among the more common are downy mildew, verticillium wilt (both the fluctuating and progressive strains) and powdery mildew (which are fungus diseases) and nettlehead, split leaf blotch, and mosaic (which are virus diseases). A large part of control of hop diseases consists of good hygienic practices, including good drainage, spring dressing, proper training, pruning, and stripping; all these are described above. Care must also be taken to plant disease-free stock on "clean" soil and to remove all dead and diseased material as frequently as possible. Additional disease control is accomplished by frequent dusting or spraying with fungicides, and control of the insect populations which help spread diseases from plant to plant. The most damaging insects to English hops are: the damson-hop aphid, the red spider mite and the hop flea beetle. Others such as the hop capsid, the common earwig, the hop leaf hopper, and the like, are so well-controlled by the regular spraying and dusting program that they are no longer of much importance.

A typical spraying and dusting program followed by English hop growers is:

<u>Time of Year</u>	<u>Pest</u>	<u>Pesticide</u>
Early - mid-May	Flea beetle	DDT if needed.
Late May - early June.	Aphids and red spiders Powdery mildew.	Demeton methyl. Sulfur or dinocap.
Mid-June	Downy mildew Powdery mildew.	Copper fungicide. Sulfur.
Late June (or when the bine reaches the top wire)	Red spider and aphids. Downy mildew Powdery mildew.	Dimefox (systemic soil drench). Copper fungicide. Sulfur.

The two mildew treatments are repeated at 2-3 week intervals until the middle of August. In addition, dry Bordeaux mixture is dusted on the crown every two weeks starting with the emergence of the first shoots in April, till about the first of June. The various materials are applied either as a dust or a spray, as it suits conditions. The cost of pesticides alone made up 15 percent of growing costs in 1964.

Harvesting and Processing

English hops ripen over an extended period, with picking usually beginning at the end of August and ending about the first of October. By planting several varieties with different ripening times, the English hop grower lengthens his harvest. This enables him to get the most out of his investment in picking and drying equipment and labor. Where a grower has only one variety, he must have a larger capacity picker and drier to handle a given size crop or else must begin picking before the peak of maturity and extend picking beyond the optimum time.

MACHINE PICKING.--Currently, well over 90 percent of English hops are machine picked as compared with only about 3 percent in 1950. This rapid growth of mechanization has brought about a substantial saving of labor expense for picking. As a result, picking expenses (as estimated by the Hops Marketing Board) have fallen 45 percent from 1952 to 1964, and total harvesting costs have dropped from 29 percent to 16 percent of the "farmgate cost" of producing hops.

Table 4.--U.K. HOPS: Mechanization of harvesting

Year	Machines used	Share of crop picked	Year	Machines used	Share of crop picked
	Number	Percent		Number	Percent
1949.....	11	1 2	1955.....	1 201	26
1950.....	23	1 3	1956.....	1 256	40
1951.....	51	1 8	1957.....	1 351	49
1952.....	69	1 10	1958.....	1 444	58
1953.....	76	1 11	1963.....	--	86
1954.....	103	17			

¹ Estimated by FAS from other data.

Source: Hops Marketing Board.

The English system of machine harvesting is much like that used in the United States, where picking is done--as in England--by a stationary machine. The bine and string are cut 4-5 feet above ground, and a tractor-drawn trailer (U.S. growers usually use trucks) is pulled under it. The butt end of the bine is placed between upright bars on the front end of the trailer, then the top of the string is cut free from the overhead wirework. The bines are draped alternately first along one side of the trailer, then along the other. This prevents tangling. When each trailer is loaded, it is taken to the picker.

English pickers--virtually all stationary machines--are mostly of the upright revolving drum type. Except for this revolving drum picking mechanism, these are much like the more common U.S. machines. For the picking process, the butt of the bine is fastened to a hook connected to a chain. The chain rides along a track to a point over the picking drums. The track then bends down sharply and allows the inverted bine to be lowered between two rapidly revolving drums covered with wire "fingers." These strip the cones, leaves, and lateral arms from the main bine which along with the string is then chopped and discarded.

At this point, the laterals are separated from the other material by screening or passing over narrowly spaced rollers, then run through a small lateral or "side arm" picker. The cones and picked materials from this process are returned to join the other cones and leaves. The lateral stems are chopped and discarded.

The next process is cleaning. The cones and leaves are passed over a fine screen to remove loose seed, petals, and fine trash, after which the leaves are removed by running the mass over a fan. This blows the leaves and other light material against a wire mesh belt which carries the light material away from the airflow to be discarded. In some machines, a rotating perforated metal drum replaces the mesh belt.

Recleaning is the final machine process and it is now usually done by a series of inclined rubber belts down which the cones are tumbled. The first belt is set at the flattest angle and the last belt at the steepest angle. As the round cones roll down, the more angular material such as leaf and stem parts and some cones are carried up and dropped onto the next steeper belt. As the material passes over successively steeper belts, fewer cones are carried to the top of each until on the last belt very few cones and most of the trash is carried up and dropped onto a trash conveyer. There is an art in setting the angle of the steepest belt to remove as much trash as possible without excessive waste of cones. The best angle depends on the weight, size, shape, and ripeness of cone and the moisture content of the hops, and it is frequently adjusted throughout the day. Many growers also employ several people to hand-sort the final product.

Most growers carry their hops in burlap pokes or bags to the kiln to dry them. These are replaced in some of the more modern systems by large bins, slat or mesh-bottomed, on either skids or wheels; in these, the hops are carried and dried. However, on most British hop farms the handling system is not as mechanized as in the United States, but a great deal of modernizing of old handling, drying, and baling systems has been done in the past few years.

DRYING.--Kiln types range all the way from the old round brick oast houses with conical roofs and natural-draft air movement, dating back into the 19th century, to modern two-storied kilns using forced hot-air. While many of the old round oast houses remain, most have been modernized to include forced hot-air-drying. The larger more modern kilns are heated by open flame oil burners or else an oil burner fitted with a heat exchanger to prevent contamination of the hops with combustion products. The floor of the kiln consists of slats covered first with a horse-hair mesh, then with burlap. Louvers underneath some floors can be used to adjust the airflow.

Under the drying floor, there is a plenum chamber (a large room sometimes fitted out with baffles) which serves to even out the air flow from the fan to avoid blowing holes in the hops. Here, the air from the fan flows over a pan of burning sulfur to pick up a charge of sulfur dioxide which helps bleach the hops. It then passes up through the drying floor and through the hops, picking up moisture and carrying it out through a full-length vent in the top of the drying chamber.

The drying method commonly used in England calls for the hops to be spread about 24 inches deep, an air-speed of about 30 feet per minute and an air temperature of 110°F. for the first hour. The temperature is increased 10° each hour up to a maximum of 150° at which level it is held until the hops are dry. In contrast, in the United States, hops are usually spread 36 inches deep and dried at an air-speed up to 60 feet per minute at temperatures of 150°F. The English method described above takes 9 or 10 hours to lower the moisture content from about 80 percent in green hops to the usual 6-7 percent. Experimental work at Wye College has shown that by using faster air speeds the initial and maximum temperatures can be safely raised thereby shortening drying time and increasing the capacity of a given size of kiln. However, instituting such a change would require reeducating the kiln foreman who has learned his art over many years.

The end point of drying is usually determined by feeling the hops, but some growers have adapted various moisture meters to do this job. Some have even--more or less successfully--made drying completely automatic, with a combination of timing devices and of automatic moisture meters regulating temperature and air-flow.

COOLING.--When the hops are dry enough to average about 6 percent moisture, the bracts (petals) contain about 4 percent and the strings (to which the bracts are attached) about 12 percent. In addition, hops on the top layer are much damper, and those on the bottom much drier, than the

average. Because of this, the hops must go through an equalization process called "cooling." In England, hops are frequently "cooled" with only a cloth covering, right out on an open floor. A few growers, however, use tightly closed cooling rooms (like those used in the United States).

PACKING.--After several hours, but usually when it is most convenient, the hops from the cooling floor are packed in "pockets." These are jute bags 7 1/2 ft. long and 2 ft. in diameter. The pocket is suspended from a hole in the cooling room floor and the hops are pushed into it with a "scuppet," which is a large wood-and-canvas scoop. When the pocket is full of loose hops, the circular pressure plate of the press is lowered by hand or electric power to compress them. This step is repeated 8-12 times to completely fill a pocket with about 1.5 cwt. (168 lb.) of hops at a density of 8.5-9 lb. per cu. ft. The top of the pocket is then sewn shut and the pocket is released to drop to the floor below. In contrast, the baling system used in the United States requires only 2 or 3 compression strokes to produce a bale weighing about 200 lb. However, much more sewing is required to bind the bale (both sides and both ends).

The Hops Marketing Board requires that each pocket be marked with the grower's name, a serial number, the county and parish where grown, the year of harvest, the weight, and at the grower's option the variety of hops. About the second or third day after packing, each pocket is tested in 2 or 3 places with an electronic-probe-type moisture meter to assure that it is properly dried. Then the hops are ready for marketing.

MARKETING

The Hops Marketing Board and the highly controlled system with which it is identified have had a strong influence on the hops industry in the United Kingdom. The present high degree of production and price stability is in strong contrast with conditions before the Board was formed. While it might be possible to speculate as to whether the controls have caused prices to be higher or have slowed the process by which production has been concentrated into fewer but larger units, for the purposes of this section it is sufficient to note that the changes that have occurred have been moderate and relatively "painless." If the regulation of the market is not universally esteemed, at least everyone accepts it as necessary to the stability of the industry. The days of drastic price and acreage fluctuations are far behind and the major uncertainty remaining now is what will happen to British hops if Britain joins the Common Market.

History

The current system evolved out of the unregulated market prior to World War I, moving through a series of early efforts to regulate the market which included government management and cooperative marketing. The failures of early efforts were generally caused by either inflexible or insufficient regulation. The supply of hops in the market place was not sufficiently related to demand to create price stability. Under the Hops Marketing Scheme of 1932, the Permanent Joint Hops Committee was established in 1934 to help match the supply to the demand, and the scheme has worked effectively ever since.

HOP CONTROL.--The first official restrictions imposed were known as Hop Control; these consisted of import controls, prices established by the Control Committee, and restricted acreage, and were in effect from 1917-24. However, in 1918, low yields left the brewers short of hops. By November 1919, acreage allotments had to be raised by 50 percent and import restrictions relaxed. Thereafter, increased hops imports, a series of good crops, and an increase in the beer tax all resulted in accumulation of large stocks. So, early in 1923, the Ministry of Agriculture advised

growers to limit their production and subjected them to a marketing quota for the coming crop in order to clear both the new crop and the old stocks. These efforts to protect prices were frustrated when the 1924 crop turned out to be very heavy and a large surplus remained when the Hop Control ended in 1925.

THE COOPERATIVE.--When the Control ended, growers who controlled 86 percent of all hop acreage formed a marketing cooperative, English Hops Growers Ltd. It used a market control system similar to the one employed under Hop Control. Members agreed to market all hops through the cooperative and limit their acreage to their 1924 level. However, because of heavy carryover stocks from the large 1924 crop and because of excessive 1925 and 1926 production, the co-op was forced to require members to reduce their acreage.

During this period, when co-op members were restricting their production, nonmember growers were able to increase their acreages and sell their crops at a profit. This leads one to believe that the price expectations by the co-op were set a bit too high for success under a voluntary system. At any rate, by 1928, only 78 percent of English hop acreage was controlled by the co-op and its members decided to abandon the project.

In 1929 -- the first year of open market since 1917 -- there was again a very large crop, resulting mostly from a high average yield. This caused the market to break, and in spite of the lower acreage and moderate crop in 1930, and the very small crop that followed in 1931, prices did not recover enough to convince growers that an uncontrolled market would work.

As a result, hop growers were the first British producers to take advantage of the Agricultural Marketing Act of 1931, which permitted industry agreements much like U.S. marketing orders, only stronger. Under the Act, ballots were mailed to all probable hop growers. Of all ballots returned, 77 percent by acreage (96 percent of all valid ballots) were in favor of a marketing scheme.

THE HOPS MARKETING SCHEME.--The Hops Marketing Scheme of 1932 was then set up and a Hops Marketing Board was established and given monopoly powers to sell English hops. While the Scheme gave the brewer no power whatsoever in determining supply, the Board was required to accept all hops brought in by growers and was consequently under pressure to dispose of them on the market. Thus, in 1933, when the British beer tax was reduced and Prohibition was ended in America, increased demand for English hops enabled the Board to raise hops prices to 68 cents a pound. Whereas, on a cost-plus-20-percent-profit basis the price would have been about 45 cents.

As a result of brewer discontent with excessive prices under the Scheme, it was amended in 1934 to establish the Permanent Joint Hops Committee whose duty was to estimate the market demand, set prices, and otherwise supervise the Scheme. Since the Committee represented both brewers and growers equally and had three independent members who could swing a vote in either direction, it proved acceptable (with some minor reservations) to all concerned. From the establishing of the Permanent Joint Hops Committee to the present, the Scheme has changed only slightly.

Market Structure

The present U.K. hops marketing system as regulated by the Hops Marketing Scheme of 1932 (as amended) consists of growers, factors (the growers' agents), the Hops Marketing Board, the Permanent Joint Hops Committee, merchants (dealers), and brewers. The function of each has become fairly standardized and the system will probably change very little in the near future.

PRODUCERS.--Anyone growing English hops for sale in the United Kingdom, or for export, must be registered with the Hops Marketing Board. There were about 700 registered producers in 1965 (down from 951 in 1950). With a few strictly limited exceptions, growers must sell their hops to the Board, and the Board must accept all hops tendered to it by registered producers.

Producers are required to furnish such records relating to their hops as may be needed under the Scheme (production costs for use by the Costing Committee, record of purchases or sales of hops and the like).

FACTORS.--Traditionally, factors acted as growers' selling agents and provided such services as furnishing production credit and advice. Now, however, they are agents of the Board and their main functions include selling hops to dealers and brewers, advising the Board on the grade make-up of the crop for provisional pricing, furnishing advice to growers, and selling annual quota (see "Operation" section) for growers, and the financing function is performed by the Board.

There were 5 factor firms operating during the 1966 season down from 13 in 1919. The number of firms has been declining as some drop out of existence and some others merge their operations.

THE BOARD.--The Hops Marketing Board consists of 14 district grower-representatives, 4 special representatives-at-large (who may or may not be growers but who are at present not growers), and 2 members selected by the Ministry of Agriculture, Fisheries, and Food. Makeup of the Board, in number of members by growing district, is: East Kent, 2; Mid Kent, 3; Weald of Kent, 3; Hampshire, 1; Sussex, 1; Worcester, 1; and Hereford, 3.

The Board is charged with administration of the Scheme, which serves only one purpose--to get the hops into the hands of the Board. At this point, the Agreement takes over--this is renegotiated periodically between the Board and the Brewers' Society and serves to transfer hops from the Board to individual brewers.

THE COMMITTEE.--The Permanent Joint Hops Committee consists of 4 members from the Hops Marketing Board, 4 members from the Brewers' Society, and 3 independent members appointed by the Minister of Agriculture, Fisheries and Food. Its duties are: to set an annual average selling price, to estimate import requirements, and to recommend an import quota to the Board of Trade. In addition, the independent members estimate the market demand for English hops and arbitrate any disputes between the Brewers' Society and the Board.

MERCHANTS.--About 11 firms of hop merchants or dealers still operate under the Scheme as against 35 in 1919. However, their power has been considerably reduced and their number is declining. They now act more or less as brewers' agents although they also occasionally buy for their own account. They also import and export hops. Since selling prices are determined by the Board within the framework of the average selling prices set by the Permanent Joint Hops Committee, the dealer can generally operate only on the basis of a commission paid by the brewer for whom he is buying. While this commission is fairly standard, some brewers may get slight reductions on large orders.

BREWERS.--The brewer's function in this setup is simply to consume the hops in the making of beer. However, a brewer may grow hops without registering with the Board and without any other restriction if he does not wish to sell any of his own production. In practice, some brewer-growers register with the Board and maintain a quota in order to sell certain types or qualities of their own crop which they do not wish to use. There are about 300 breweries in the United Kingdom with the 8 largest selling 75-80 percent of the total.

For the purpose of the Hops Marketing Scheme, an extract producer is considered a brewer, but hops extract is not considered hops. In other words, a grower need not register with the Board if his hops are changed into extracts before he sells them. However, if he wants to sell hops to an extractor he must register and have a quota.

Market Operation

The Scheme exerts control through the two basic operations of supply control and a price agreement. Supply control is accomplished through a combination of import controls and marketing quotas. The price agreement is based on the cost of production and is renegotiated annually between the Brewers' Society and the Board. It is implemented through prices being established for each lot of hops by a Valuation Panel. The price is arrived at by considering the average cost of production and the value of that lot in relation to the entire crop.

SUPPLY CONTROL.--In order that marketing quotas and price agreements can be effective, it has been necessary to restrict imports. The Board of Trade limits hops imports by licensing. Each year brewers advise the Permanent Joint Hops Committee of their requirements for foreign hops of special types not available in the United Kingdom. The Committee then determines the quantity which should be allowed to enter and requests that the Board of Trade limit the issue of licenses to this level of imports. In the event of a short crop or of other reasons for special imports, and on approval by the Committee, the Board of Trade may license extra imports. For the year ending August 31, 1966, the Committee recommended that imports be limited to 1,344,000 pounds. It is this element of the marketing system which is most vulnerable if Britain joins the Common Market.

To control the supply of English hops, the Hops Marketing Board fixes each grower's marketing quota or the quantity of hops for which he may expect a guaranteed market each year. To do this, the Board first established a national Basic Quota based on historic market requirements. (This is used only as a guideline and is currently revised every 5 years.) Each grower gets a prorated share of this national Basic Quota (based on his marketing history) as his own basic quota.

Each brewer, as required by the Agreement between the Brewer's Society and the Hops Marketing Board, notifies the Permanent Joint Hops Committee in January each year of his estimated requirements for hops from the coming harvest. In addition, he must contract with the Board to buy at least 90 percent of his requirements for English hops. In practice, all brewers contract for the entire amount of their estimated needs at this time.

Having in hand the above information, the Committee estimates (in February) the home market demand (by brewers in the United Kingdom, the Channel Islands and Ireland) for English hops of the coming harvest. (This estimate excludes hops already sold directly by contracts between brewers and growers with such contracts already registered with the Board.) The Committee then presents the estimate of domestic demand to the Board.

The Board fixes a percentage of the national Basic Quota which will cover this estimated home demand plus estimated export demand (based on export orders submitted to the Board by dealers). This percentage is called the Annual Quota and is first set in February. However, it may be revised later in the year to cover export orders received at a later date. The grower's marketing quota then is determined by multiplying this Annual Quota percentage by his prorated share of the national Basic Quota.

As an example, in 1966 the national Basic Quota was 25,806,000 pounds. The Committee determined that home demand was 22,055,000 pounds. To cover this and export orders received to date, the Board on February 11, 1966, fixed the Annual Quota at 88.5 percent of the above Basic Quota. On May 17, in spite of a few additional export orders, the Board held the annual quota at 88.5 percent, but on July 27, because of the receipt of additional export orders, the annual quota was raised to 89 percent of the Basic Quota.

SALE OF QUOTA.--Growers who fail to produce enough hops to fill their annual quota are allowed to "sell" (before September 1) annual quota to any other registered producer upon approval of the Board. This takes the form of a joint request to the Board that the annual quota of the one

Table 5.--U.K. HOPS: Quota and market demand, selected years

Year of harvest	Estimated market demand ¹			National Basic Quota	National Annual Quota	Import Quota
	Home	Export	Total			
	<u>1,000 lb.</u>	<u>1,000 lb.</u>	<u>1,000 lb.</u>	<u>1,000 lb.</u>	<u>Percent of basic</u>	<u>1,000 lb.</u>
1950.....	29,498	3,878	33,376	32,952	109.0	112
1951.....	27,878	4,902	32,780	32,952	103.5	112
1952.....	26,264	2,651	28,915	32,952	88.5	112
1953.....	24,876	1,721	26,597	32,952	84.0	112
1954.....	24,080	1,394	25,474	32,952	81.0	112
1955.....	22,907	1,462	24,369	26,769	95.0	112
1956.....	23,294	603	23,897	26,769	96.0	112
1957.....	28,078	1,402	29,480	26,769	116.0	672
1958.....	27,041	2,733	29,774	26,769	116.0	672
1959.....	20,944	281	21,225	26,769	84.5	672
1960.....	22,906	57	22,963	25,680	95.0	672
1961.....	25,012	603	25,615	25,680	104.5	896
1962.....	29,075	507	29,582	25,676	121.5	1,456
1963.....	26,905	477	27,382	25,676	110.5	1,344
1964.....	24,396	621	25,018	25,676	101.5	1,288
1965.....	24,829	673	25,502	25,806	103.0	1,344
1966.....	22,055	112	24,829	25,806	88.5	1,344

¹ As of the date of the annual (June) meeting of registered hop producers.

be reduced and that of the other be increased. Annual quota may sell for next-to-nothing during years when there are low yields and nearly as high as the price of hops during years of high yields. Since the periodic re-allotment of Basic Quota is based on a grower's production over the preceding 5 years, a grower who frequently produces less than his annual quota will suffer a loss of part of his Basic Quota allotment, and vice-versa.

In addition, when one grower sells hop land to another, the Basic Quota (covering that hop land) lapses for the first farm and is allotted to the second farm. Therefore, farmers who do not have Basic Quota allotments may acquire them by buying hop land. During the year beginning April 1, 1965, a total of 461,888 pounds of Basic Quota sold for \$493,861, or an average of \$1.07 per pound. Over the past 7 years (1960-66), the average price of Basic Quota was \$1.00 per pound.

VALUATION.--Selling prices and valuations to growers are related to a predetermined average price of hops for each season which, since 1949, has been based on the cost of production. Each year, representative growers are required to submit to the Board cost-of-production records covering the past season's crop. From these records and other information the Board, in close collaboration with representatives of the Brewers' Society, computes the total cost of producing and marketing the nation's crop. This computation is presented to the Permanent Joint Hops Committee which uses it to determine the average price.

The contracts that brewers enter into with the Board each year provide that the hops will be bought at the valuation prices determined by the Board, with the proviso contained in the agreement between the Brewers' Society and the Board, that these prices shall, if necessary, be adjusted so that the weighted average of all such prices shall correspond with the average price for the crop.

To apply the average price to any particular grade of hops, it is necessary for the Board to go through an elaborate procedure of pricing each grade and then valuing each lot of hops in relation thereto.

Each season, samples are taken from every pocket of hops delivered to the Board. From samples of every tenth pocket, the Board's commercial manager selects representative samples for each grade within each variety. The Board estimates (after consulting with factors) the quantities of the crop which will fall into each grade. The Grading Committee, consisting of an equal number of members from the Board and the Brewer's Society, inspects the representative samples and decides the provisional value for each grade, based on their relative qualities, the season's average price established by the Board, the estimated quantity in each grade, and the relative demand for each variety and grade.

The Board's valuation panel then examines samples of every growth and places a value on each sample or comparable lot of samples. This valuation is on the old standards of color, uniformity, wholeness of cones, texture, rub, and aroma. While individual brewers may buy on the basis of chemical analysis as well, the valuation panel does not attempt to consider this factor in setting the price. These values are subject to appropriate appeal procedure, and, as a last resort, to arbitration.

This system of valuation requires the use of a very consistent strength and quality of light to avoid any outside influence on the visual inspection. Therefore, all valuation had previously been done in full natural daylight. However, recently, a system of artificial lighting was devised to allow valuation on cloudy days, mornings, evenings, and the like. The work, which used to extend into March and occasionally into early April, is now finished in mid-February.

SALES.--The customary selling process under the Scheme consists of a brewer "nominating" (in November) a merchant to act as his purchasing agent. Factors who sell hops for the Board must (according to custom) offer particular lots of hops first to the merchants who bought the corresponding growths the previous year. Therefore, a brewer usually "nominates" the merchant who has first chance at the particular lot which the brewer wants to buy. In practice, this builds a traditional relationship, with a given brewer retaining the same merchant and buying the same growth year after year. However, there are some changes in the pattern, as merchants secure nominations from new brewer clients from year to year or brewers seek new growths. In some cases, brewers act as their own agents.

After the merchants have been "nominated," factors present samples of each lot to the traditional buyer. The merchant keeps the samples of lots for which he has nominations but must return by a specified date samples in excess of his nominations. These in turn are offered to other merchants who do not have sufficient hops on call to cover their nominations. After all merchants fill their nominations, remaining stocks are sold on a first-come-first-serve basis.

If, after valuation, a buyer thinks a lot that he has purchased is overvalued by the panel, he may refuse it and buy hops from the reserve pool in its place.

GROWER PAYMENTS.--Before the lengthy process of valuation and paying growers is completed, the Board usually makes an advance payment to each grower of up to two-thirds of the estimated value of his crop. This is considered as a loan against which final payment for his crop is applied.

After valuation is completed, the Board deducts any advance payments made, the factor's fee (currently 3 percent), and a sum to cover Board expenses (3.4 U.S. cents per pound in for the 1965 crop). Then it pays the remainder due on quota hops to the grower.

The Board is obliged to pay the valuation prices only for hops delivered within each grower's marketing quota. It may then distribute any surplus receipts to deliverers of non-quota hops on the basis of the quantity delivered. In practice, growers usually receive little or no payment for non-quota hops.

Table 6.--HOPS MARKETING BOARD: Deductions from grower payments, 1955-65

Year of harvest	Factors' commission Percent	Board expenses U.S. cents per lb.	Year of harvest	Factors' commission Percent	Board expenses U.S. cents per lb.
1955.....	2.50	1.94	1961.....	2.75	4.06
1956.....	2.50	4.44	1962.....	2.75	2.71
1957.....	2.75	3.12	1963.....	2.75	3.34
1958.....	2.75	2.44	1964.....	3.00	3.12
1959.....	2.75	3.19	1965.....	3.00	3.38
1960.....	2.75	2.96			

SUPPLY AND DISTRIBUTION

Since hops are used almost exclusively as an ingredient of malt beverages (mainly beer) and since there is no suitable substitute for them (in one form or another) the market for them is highly inelastic. A relatively accurate idea of both supply and distribution of hops is therefore essential to an evaluation of the United Kingdom both as a potential competitor with and as a possible market for United States hops.

The Hops Marketing Board considers Ireland as part of the "home market," mostly because the major part of Irish beer is produced by the same major British breweries with which it contracts to sell hops in the United Kingdom. However, since the import quota can't apply in Ireland, and since from the standpoint of the U.S. exporter Ireland is a separate market, this section of the report excludes Ireland from the "home market."

Table 7.--U.K. HOPS: Supply and distribution

Year beginning October 1	Beginning stocks ¹	Production	Imports	Total supplies	Exports	Domestic disappearance ²	Ending stocks ¹	Total distribution
	1,000 lb.	1,000 lb.	1,000 lb.	1,000 lb.	1,000 lb.	1,000 lb.	1,000 lb.	1,000 lb.
1955.....	19,683	28,764	547	48,994	5,246	24,970	18,778	48,994
1956.....	18,778	20,627	1,179	40,584	3,312	24,428	12,844	40,584
1957.....	12,844	29,979	575	43,398	4,834	23,872	14,692	43,398
1958.....	14,692	33,896	668	49,256	5,863	24,734	18,659	49,256
1959.....	18,659	25,051	852	44,562	1,863	25,761	16,938	44,562
1960.....	16,938	27,915	1,067	45,920	1,833	26,726	17,361	45,920
1961.....	17,361	22,818	2,498	42,677	2,021	25,754	14,902	42,677
1962.....	14,902	29,883	1,594	46,379	2,163	25,892	18,324	46,379
1963.....	18,324	30,955	1,208	50,487	2,336	27,181	20,970	50,487
1964.....	20,970	28,269	1,668	50,907	2,460	³ 27,000	21,447	50,907
1965 ⁴	21,447	28,977	1,314	51,738	2,803	³ 27,300	21,635	51,738

¹ Stocks figures are estimates by FAS based on a "normal" level of 1/2 - 3/4 of a year's requirements and are calculated as a residual.

² Disappearance figures include brewery usage of hops and extracts converted to hops equivalent at 2.5:1 and miscellaneous disappearance estimated at 1.5 percent of production.

³ FAS estimate or forecast.

⁴ Preliminary.

Supply

The supply of hops in England, as in other countries, fluctuates fairly sharply. While, in England, acreage changes have been very gradual under the Scheme, yields still fluctuate sharply because of the extreme influence of weather conditions on this delicate crop.

Also, weather differences cause wide variations in the quality of successive crops, and this creates problems of how to maintain a uniform flavor in beer brewed from these hops. To offset quality variations, brewers have carried heavy stocks to blend one year's crop with the next and avoid rapid changes in taste and other characteristics. These large stocks also provide plenty of opportunity for the supply's fluctuating without curtailment of consumption.

PRODUCTION.--U.K. hops production has ranged from 20 million to 34 million pounds in the past decade, in spite of a very stable acreage, and in 1966 the crop totaled 25,639,000 pounds. The crop is all available to brewers either as quota or non-quota hops (as explained under Marketing) except for small quantities which are exported. In contrast, in the United States, "reserve pool" hops will not usually be permitted to enter domestic market channels under the Marketing Order.

As mentioned before, there is no apparent production trend, but if Britain enters the Common Market this situation might be changed. This, of course, would depend on the extent that hops imports would be liberalized.

STOCKS.--Normal brewery stocks are said to be around one-half to two-thirds of a year's supply. Since no official stocks data are available, those presented in the supply and distribution table were calculated as a residual based on normal levels mentioned above, some variations in stocks may represent a movement into or out of the hands of the Hops Marketing Board and dealers' warehouses. However, neither the Board nor dealers "usually" carry any significant stocks into a new season.

There is no apparent long-term trend in the level of stocks. However, by the end of the 1965-66 marketing year, stocks appear to have risen to their highest in recent years. It was probably these high stocks, combined with the recent decline in domestic requirements, which brought about the sharp drop of national annual quota from 103 percent in June 1965 to 88.5 percent in June 1966. Because of this, stocks probably hit a short-term peak on October 1, 1966 and should begin a decline.

IMPORTS.--In recent years, imports of hops have been rising substantially (from 0.5 million pounds in 1955-56 to 1.3 million in 1965-66). However, under the Hops Marketing Scheme, in the long run, imports have dropped from an average of 5.0 million pounds in 1934-38 to only 1.6 million pounds in the 1960-64 average season. This is caused mostly by the imposition of an import quota system which was mentioned under Marketing. A comparison of imports and the import quota shows that in the 10 years 1956-65 imports exceeded the quota in all but 4 years (1957, 1958, 1963 and 1965); in some years (1956 and 1961 in particular), imports were several times greater than the quota. This shows the flexibility of the system under which importers may request licenses for hops in excess of the limit on approval by the Permanent Joint Hops Committee.

In past years, imports were mostly irregular shipments to make up for shortages of domestically grown hops. Recently, however, the growing production of "lager" type beers has created a demand for continental types of hops, and imports of premium Yugoslav and West German hops have increased accordingly. This trend has as yet had only a minimal effect on the level of imports. During the past 10 years, Yugoslavia has been the leading supplier of hops to England, with West Germany second and Belgium third. The United States sold only negligible amounts of hops to England in earlier years, but during the past 5 seasons these sales have increased to an average of 0.2 million pounds. This apparent upward trend seems to have accompanied a general upward

trend in total British hops imports which is probably the result of increased production of lager and other specialty beers. This is not expected to be a major trend and will influence the English hops market very little.

The English duty is 6.7 U.S. cents per pound on hops from all Commonwealth countries and 10 cents from other countries. The government also reserves the right to levy an import surcharge when necessary but there is currently none on hops. In addition, an import license is required and imports are limited by the quota system mentioned above. If Britain were to join Common Market, the common external duty would become 12 percent ad valorem and there would be no internal EEC duty. There is at present no indication as to whether or not the United Kingdom would be allowed to retain its special low rates on Commonwealth goods but few hops are imported from Commonwealth countries anyway.

Table 8.--U.K. HOPS TRADE: Exports by destination and imports by origin, average 1955-59,
annual 1955-56 to 1964-65

Country	Average 1955-59	Year beginning October 1									
		1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
Exports:		1,000 pound	1,000 pound	1,000 pound	1,000 pound	1,000 pound	1,000 pound	1,000 pound	1,000 pound	1,000 pound	1,000 pound
United States..	--	--	--	--	--	--	--	--	10	1	1
Australia.....	532	1,273	137	323	925	--	6	535	40	1	515
Belgium.....	253	200	156	407	338	166	132	154	197	219	133
Denmark.....	20	4	4	47	46	--	--	7	24	3	--
Ireland.....	2,802	3,308	2,543	3,588	3,588	1,417	1,495	1,190	1,667	1,757	1,572
Other countries	617	461	472	901	966	280	200	135	225	355	239
Total.....	4,224	5,246	3,312	4,834	5,863	1,863	1,833	2,021	2,163	2,336	2,460
											¹ 2,803
Imports:		1,000 pound	1,000 pound	1,000 pound	1,000 pound	1,000 pound	1,000 pound	1,000 pound	1,000 pound	1,000 pound	1,000 pound
United States..	5	--	--	3	--	24	42	262	404	51	282
Canada.....	--	--	--	--	1	--	--	--	130	26	171
Belgium.....	103	82	150	104	999	82	97	365	128	183	191
Czechoslovakia.	9	--	10	1	13	23	34	92	63	47	76
Germany, West..	147	127	210	76	118	205	272	539	350	240	123
Poland.....	--	--	--	--	--	--	8	119	21	54	38
Yugoslavia.....	329	228	424	227	304	462	595	908	460	533	708
Other countries	151	110	385	164	32	56	19	213	38	74	79
Total	744	547	1,179	575	567	852	1,067	2,498	1,594	1,208	1,668
											1,314

¹ Partly estimated.

Distribution

In recent years, the consumption of hops by U.K. breweries has been fairly stable while beer production has increased steadily. This has resulted from the fact that the hopping rate (rate of hops usage per unit of beer brewed) has declined steadily. On the other hand, exports have recovered gradually after hitting a long-time low in 1960-61. This recovery, however, is not expected to continue, as some sales in recent years were made to irregular buyers; in addition, English prices are rapidly becoming less competitive.

DOMESTIC CONSUMPTION.--In the United Kingdom, there were about 265 breweries producing beer during the October 1963-September 1964 brewing year. The number of breweries has fallen off sharply since World War II, while the average size has increased. With costs rising and

with government price regulations restricting beer price increases, smaller, less efficient breweries have gone out of business or merged with larger firms. In fact, 8 large firms now account for 75 percent of total beer production.

Beer production has risen steadily from 33.7 million barrels (31 U.S. gallons each) in 1955-56 to an estimated 42.1 million barrels in 1965-66. This 25 percent increase in 10 years is only half as large as the 50 percent increase in world beer production over the same period. On the other hand, beer production in the United States rose only 23 percent and in West Germany as much as 103 percent during that time.

Although most of the United Kingdom's beer production is of the traditional "top fermented" English beer which is not pasteurized and cannot be stored without refrigeration, a minor but increasing share is "bottom fermented" or lager beer which is pasteurized and can be bottled or canned and stored without refrigeration. Brewers prefer seeded English hops for the traditional brew but use seedless hops--mostly imported from Continental Europe--for lager beer.

While beer production appears to be expanding at the rate of about 2 percent a year, hops usage has increased at less than one percent a year because of a falling hopping rate. The calculated hopping rate (including hops extracts converted to hops equivalent at 2.5:1) has dropped from .727 pounds per barrel (31 U.S. gallons each) in 1955-56 to .650 in 1963-64 when U.K. breweries produced 41.1 million barrels of beer and used 26.6 million pounds of hops and 53,100 pounds of extract. In the United States, the hopping rate was .361 for that year.

In 1964-65, the 41.3 million barrels of beer produced required an estimated 26.6 million pounds of hops equivalent for a .645 hopping rate. During the 1965-66 season, the rate of hops usage is believed to have dropped again to .640. At this rate, 26.9 million pounds of hops equivalent would have been used. In spite of the drop, the United Kingdom hopping rate is still far above both the U.S. rate and the world rate, estimated at .287 and .450 pounds per barrel respectively in 1965-66.

Per capita beer production has risen from 0.66 in 1955-56 to 0.77 in 1965-66. This trend is expected to continue, except perhaps in short periods of economic retrenchment. Thus beer production should continue to expand. Hops consumption is also expected to continue to increase, but at a slower rate, as more modern brewing techniques and the increased use of hops extracts result in more efficient hops utilization.

EXPORTS.--Traditionally, the export market has taken about 10 percent of the English hops crop; over the life of the Scheme, exports have varied considerably. During 1934-38 average exports were only 2.3 million pounds, but by 1955-59 they had risen to 4.2 million and during 1960-64, fell again to 2.2 million pounds. However, in 1965-66 exports totaled 2.8 million pounds. Increased sales to Ireland and to Commonwealth countries (as a result of increased beer production in these areas) accounted for most of the increase during the 1955-59 period, but during the past 5 years these areas have been buying increasing quantities from the United States.

Usually about two-thirds of the United Kingdom's hops exports go to Ireland where branches of large British breweries produce most of the beer. Nearly all of the remaining exports go to other Commonwealth areas where a combination of import duty preferences, brewery ownership by English firms, traditional trade patterns and differences in the type of beer brewed have given English hops some advantages over U.S. hops in spite of their higher price.

However, the United States has been making inroads into these traditionally British markets in recent years because of the consistently lower U.S. price. In particular, English hops exports to Ireland have declined from an average of 2.8 million pounds in 1955-59 to 1.5 million in 1960-64 but climbed back to 2.0 million in 1965-66. By comparison, U.S. exports to Ireland rose from an average of 0.6 million in 1955-59 to 1.0 million in 1960-64. In 1965-66 U.S. exports to Ireland totaled 1.1 million pounds. As a result, English hops exports have dropped considerably in the

Table 9.--UNITED KINGDOM: Beer production and hops usage, 1955-65

Year beginning October 1	Beer produced	Hops used	Hop extracts used	Total hops equivalent ¹	Combined hopping rate
	1,000 bbl.				
	31 U.S. gal. ea.	1,000 lb.	100 lb.	1,000 lb.	lb. per bbl.
1955.....	33,734	24,508	123	24,539	0.727
1956.....	34,644	24,093	102	24,119	.696
1957.....	33,653	23,393	114	23,421	.696
1958.....	34,900	24,196	120	24,226	.694
1959.....	36,700	25,354	124	25,385	.692
1960.....	38,495	26,276	125	26,307	.683
1961.....	38,683	25,361	202	25,411	.657
1962.....	38,971	25,375	276	25,444	.653
1963.....	41,123	26,584	531	26,717	.650
1964.....	41,255	(²)	(²)	³ 26,600	³ .645
1965.....	42,089	(²)	(²)	³ 26,900	³ .640

¹ Officially reported usage of hops and extracts with extracts converted to hops equivalent at 2.5:1. ² Not available. ³ FAS estimate.

past decade. With the recent tendency toward rapidly increasing prices of English hops, future exports will probably continue the downward trend. This may be partly offset--but probably not entirely--by increasing prices in other producing nations.

HOP EXTRACTS.--While nearly all hops consumed in the United Kingdom go directly into the manufacture of malt beverages, a minor but increasing amount is processed into extracts. Most of these are used in U.K. breweries and their dry hops equivalent is included in the domestic disappearance data in this report.

There are only two major extract producers in the United Kingdom and both have branch outlets in the United States. There are no published data available on the total production of extracts in England, but an examination of brewery consumption and extract trade data indicates that only about 50,000 pounds were produced in 1963-64. Since hop extracts trade is so minor (in 1962, the last year reported, imports totaled 1,267 pounds and exports totaled only 31 pounds) it was not included in the trade table.

Outlook

In the near future it appears that English hops production will remain stable or possibly decline slightly as prices rise and English brewers employ more modern techniques to increase hopping efficiency. The marketing system and the Hops Marketing Board will continue in their present forms.

English hops exports may drop even further in the next few years as Ireland and the Commonwealth gradually switch to other sources of supply, particularly the United States. Imports will probably show some slight increase as the production of specialty beers requiring special hops is increased.

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English hops prices will continue to rise in response to increasing costs of production. While further mechanization may partially offset the tendency of rising costs, the major saving (mechanization of the harvest) has already been accomplished. A rapid increase in the size of operation, however, might help to prevent further increases in the cost of production but under the Scheme, it is unlikely that this will occur. Also there is the possibility that new higher yielding or disease-resistant varieties might help keep costs down, but in the cool damp English climate this seems unlikely.

Hop extracts will probably continue to gain in popularity with English brewers but not as rapidly as on the continent or in the United States. The switch over from hops to extract will be accelerated, however, by the increasing cost of hops.

The prospects for the industry if Britain joins the Common Market are so dependent on the conditions of entry that speculations along this line are unprofitable. However, it seems likely that under any circumstances English growers will continue to supply most of home market into the near future.